(12)UK Patent (19)GB (11)2 402 636 (13)B

(45) Date of publication: 13.07.2005

(54) Title of the invention: Cyclonic dust-collecting device and vacuum cleaner having the same

(51) Int Cl[7]: **B04C** 5/12, **A47L** 9/16

(21) Application No: **0410226.5**

(22) Date of Filing: **07.05.2004**

(30) Priority Data:
(31) **200332152** (32) **21.05.2003** (33) **KR**

(43) Date A Publication: **15.12.2004**

(52) UK CL (Edition X):
B2P P10B2A3
A4F FFD

(56) Documents Cited:
GB 2395109 A
GB 2373997 A
GB 2368269 A
US 6428589 B1
US 20020194695 A1

(58) Field of Search:
As for published application 2402636 A *viz:*
UK CL (Edition W) **A4F**
INT CL[7] **A47L, B04C**
Other: **WPI, EPODOC, PAJ**
updated as appropriate

(72) Inventor(s):
Jang-keun Oh

(73) Proprietor(s):
Samsung Gwangju Electronics Co., Ltd.
(Incorporated in the Republic of Korea)
271 Oseon-dong, Gwangsan-gu,
Gwangju-city, Republic of Korea

(74) Agent and/or Address for Service:
Withers & Rogers LLP
Goldings House, 2 Hays Lane, LONDON,
SE1 2HW, United Kingdom

FIG. 1

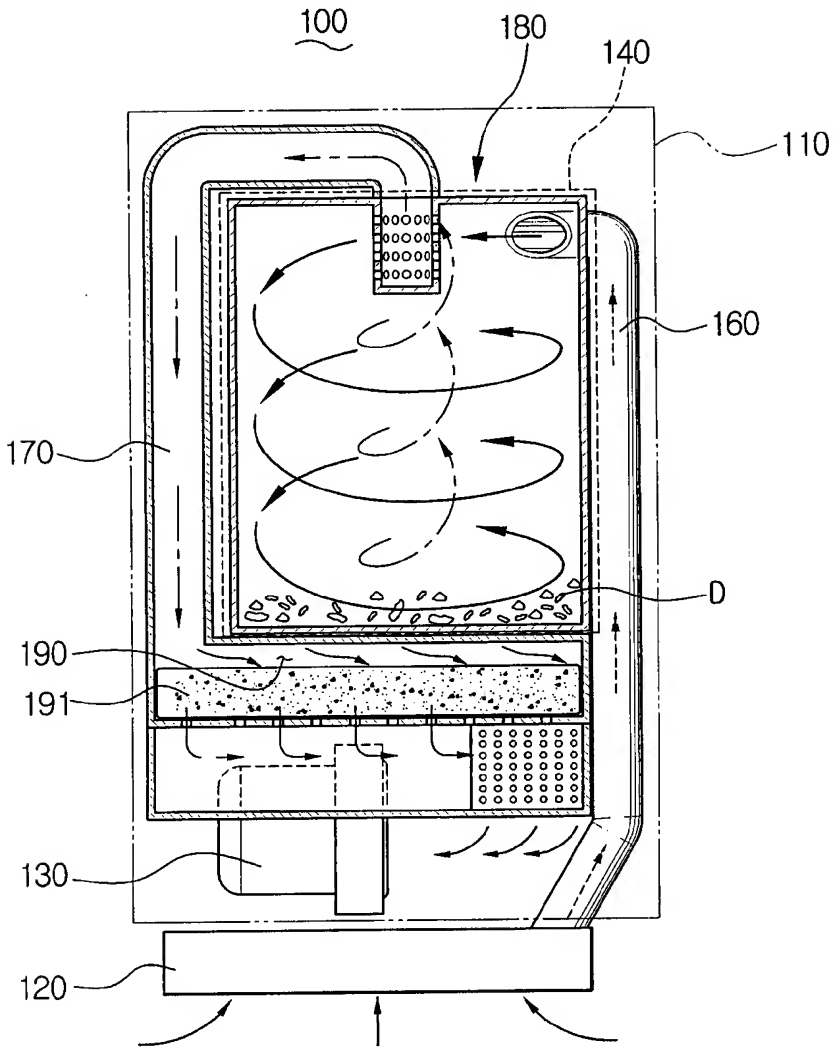


FIG. 2

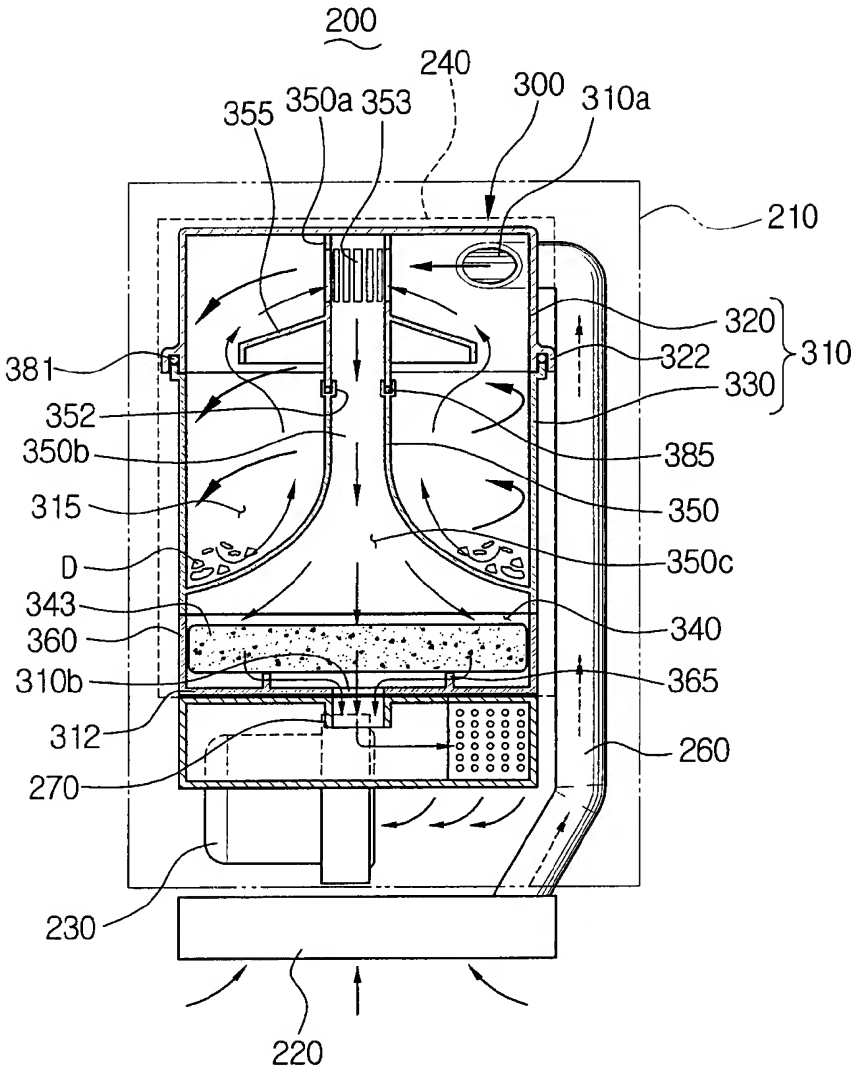
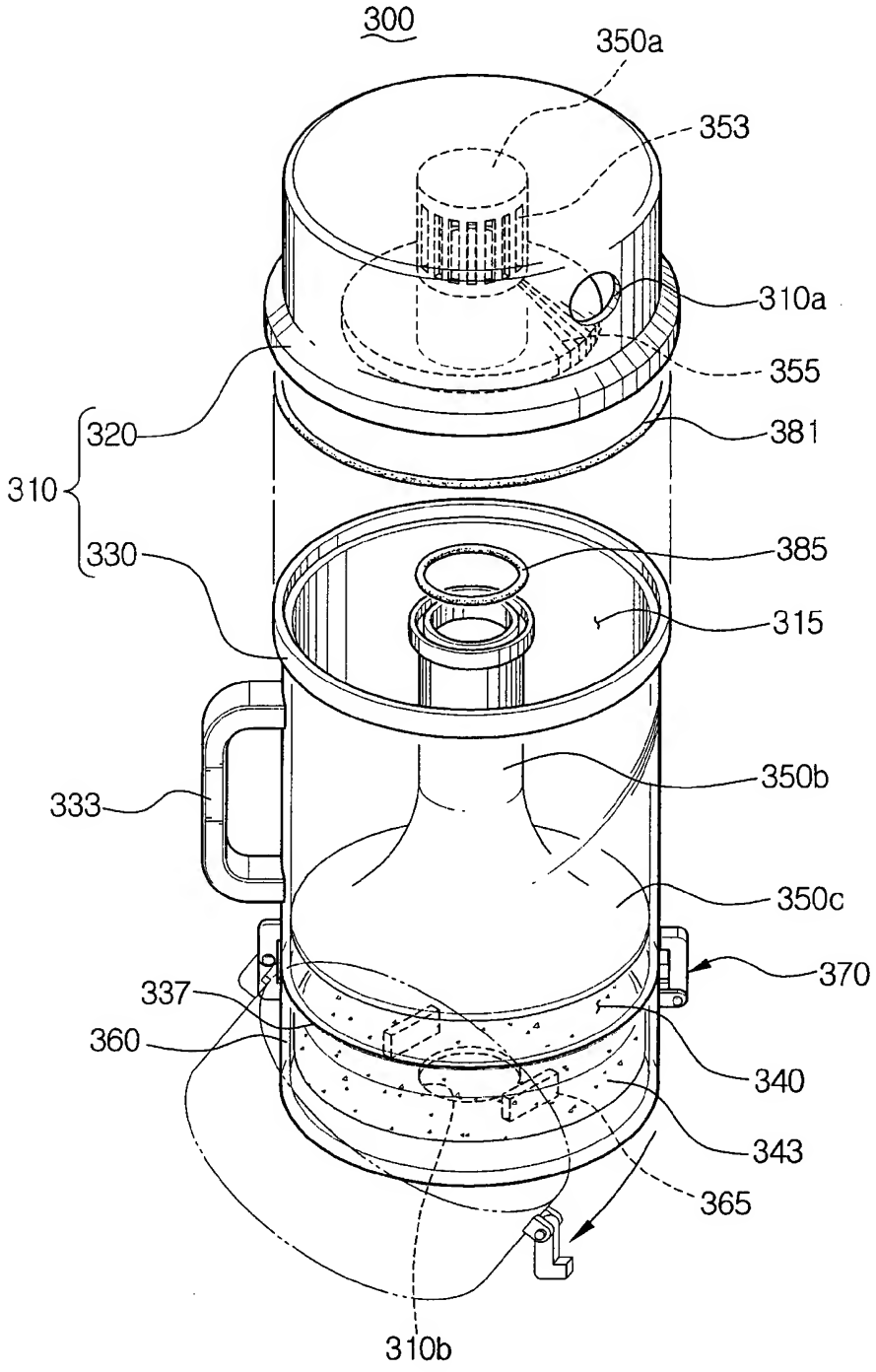

200
240
300
310a
355
350a
353
210
320
322
330
310
381
352
350b
315
D
343
360
310b
312
270
385
350
350c
340
365
260
230
220

FIG. 3


300
350a
353
310a
355
320
381
310
330
385
315
350b
333
350c
370
337
360
340
343
365
310b

Cyclonic Dust-Collecting Device and Vacuum Cleaner Having the Same

This application is related to co-pending UK patent applications 2400053, 2396099 and 2402092 whose disclosures are commonly owned by the same assignee as the present application and are entirely incorporated herein by reference.

This invention relates to a vacuum cleaner, and in particular to a cyclonic dust-collecting device for a vacuum cleaner, which centrifugally separates and collects dust from drawn-in air.

A conventional vacuum cleaner performs a cleaning operation by drawing in air containing contaminants (hereinafter referred to a "dust") from a surface to be cleaned. A typical vacuum cleaner includes a vacuum cleaner body having a vacuum generator therein, a suction port assembly to draw in dust-carrying air from the surface to be cleaned by using suction generated by the vacuum generator, and a dust-collecting device that separates dust from the air. Some conventional vacuum cleaners use a cyclonic dust-collecting device which centrifugally separates and collects the dust from the drawn-in air.

Figure 1 shows a conventional upright vacuum cleaner 100 which includes a cleaner body 110 and a cyclonic dust-collecting device 180. A vacuum generator 130 is provided, the cleaner body 110 housing the vacuum generator 130, and a dust-collecting chamber 140 is formed in an upper portion of the cleaner body, the cyclonic dust-collecting device 180 being detachably mounted thereon. The dust-collecting chamber 140 is in fluid communication with a suction port assembly 120 through a first air inlet path 160. The vacuum generator 130 is in fluid communication with the dust-collecting chamber 140 through a second air inlet path 170. Each air inlet path 160 and 170 is connected to an upper end of the dust-collecting chamber 140, and each is connected to an upper end portion of the cyclonic dust-collecting device 180 when the cyclonic dust-collecting device is mounted on the dust-collecting chamber.

A filter 191 is disposed in the second air inlet path 170 to filter dust contained in the air discharged from the cyclonic dust-collecting device 180. The filter 191 is detachably installed in a filter chamber 190 formed in the cleaner body 110, so that the filter is interposed between the second air inlet path 170 and the vacuum generator 130, separately from the cyclonic dust-collecting device 180.

The second air inlet path 170 is connected to the vacuum generator 130 along a side and the bottom of the cyclonic dust-collecting device 180, whereby air discharged from the upper end of the cyclonic dust-collecting device 180 flows through this path. Hence, the cleaner body 110 is bulky and requires a complicated manufacturing process.

In addition, it is inconvenient to support the cyclonic dust-collecting device 180 and the filter 191 separately.

The aim of the invention is to provide a vacuum cleaner with cyclonic dust-collecting device which has a simple-structured cleaner body.

The present invention provides a vacuum cleaner comprising:

a suction port assembly to draw in dust from a surface to be cleaned;

a cleaner body having a vacuum generator connected to the suction port assembly through first and second air inlet paths, with a dust-collecting chamber interposed between the first and the second air inlet paths; and

a cyclonic dust-collecting device detachably mounted in the dust-collecting chamber and connected to first and second air inlet paths;

wherein the cyclonic dust-collecting device comprises:

a cyclone body having a first through hole connected to the first air inlet path, a second through hole formed at one end of the cyclone body and connected to the second air inlet path, and a cyclone chamber for centrifugally separating dust from air drawn in through the first through hole and for collecting the dust therein; and

an air inlet pipe having an inlet port disposed in the cyclone chamber and an outlet port at said one end of the cyclone chamber and connected to the second through

hole, the air inlet pipe guiding the clean air discharged from the cyclone chamber to the second through hole; and wherein

the outlet port of the air inlet pipe is substantially frustoconical, gradually increasing in cross-section towards the lower portion of the cyclone body.

Accordingly, the second air inlet path requires less space for installation, thereby making manufacture of the vacuum cleaner easier.

The cyclone body may further comprise a filter interposed between the outlet port of the air inlet pipe and the second through hole to separate dust from the air discharged from the cyclone chamber flowing towards the second through hole.

Advantageously, the cyclone body includes a filter chamber formed between the outlet port of the air inlet pipe and the second through hole, and the filter is detachably disposed in the filter chamber.

Because the cyclone body is integrally formed with the filter chamber, the cyclone body and the filter chamber can be maintained at the same time.

Advantageously, the outlet port of the air inlet pipe divides the cyclone chamber from the filter chamber.

Preferably, the cyclone body further comprises a cyclone head unit having the first through hole connected to the first inlet path, and a dust receptacle detachably connected to the cyclone head unit and forming the cyclone chamber.

Advantageously, the dust receptacle comprises:

a first chamber defining the cyclone chamber when the dust receptacle and the cyclone head unit are connected to each other; and

a second chamber fluidly communicating with the first chamber through the air inlet pipe, and exposed and closed by a cover which is hinged to one end of the dust receptacle;

wherein the second through hole penetrates through the cover.

The invention also provides a cyclonic dust-collecting device for a vacuum cleaner, the device being interposed between a first air inlet path connected to a suction port assembly and a second air inlet path connected to a vacuum generator of the vacuum cleaner, the device comprising:

a cyclone body having a first through hole to be connected to the first air inlet path, a second through hole formed at one end of the cyclone body to be connected to the second air inlet path, and a cyclone chamber for centrifugally separating dust from air drawn into the chamber through the first through hole, and to collect the dust therein; and

an air inlet pipe having an inlet port disposed in the cyclone chamber and an outlet port at said one end of the cyclone chamber and connected to the second through hole; wherein

the outlet port of the air inlet pipe is of frustoconical shape, gradually increasing in cross-section towards said one end of the cyclone body.

The cyclone body may further comprise a filter interposed between the outlet port of the air inlet pipe and the second through hole to separate dust from the air which is discharged from the cyclone chamber and flows toward the second through hole.

Preferably, the cyclone body includes a filter chamber formed between the outlet port of the air inlet pipe and the second through hole, and the filter is detachably disposed in the filter chamber. The filter is effective to separate fine dust from the "clean" air flowing to the second through hole. The outlet post of the air inlet pipe may divide the cyclone chamber from the filter chamber.

The filter chamber may be exposed and closed by a cover disposed at said one end of the cyclone body, and the second through hole may penetrate through the cover.

The filter chamber may be provided with an adhesion-prevention member to prevent the filter from blocking the second through hole due to the flow of clean air moving

towards the second through hole. The adhesion-prevention member may be integrally formed with, and protrude from, the cover, and may include at least one adhesion-prevention rib to support the filter when the cover is closed.

The cyclone body may further comprise a cyclone head unit provided with the first through hole, and a dust receptacle detachably connected to the cyclone head unit, and forming the cyclone chamber.

The invention further provides a cyclonic dust-collecting device for a vacuum cleaner, the device being interposed between a first air inlet path connected to a suction port assembly and a second air inlet path connected to a vacuum generator of the vacuum cleaner, the device comprising:

a cyclone body including a cyclone head unit having a first through hole to be connected to the first air inlet path and a second through hole to be connected to the second air inlet path, and a dust receptable detachably connected to the cyclone head unit and forming the cyclone chamber for centrifugally separating dust from air drawn into the chamber through the first through hole; and

an air inlet pipe having an inlet port disposed in the cyclone chamber and an outlet port at one end of the cyclone chamber and connected to the second through hole, the outlet post being of frustoconical shape, gradually increasing in cross-section towards said one end of the cyclone body, wherein the dust receptacle comprises:

a first chamber which forms the cyclone chamber when the dust receptacle and the cyclone head unit are connected to each other; and

a second chamber in fluid communication with the first chamber via the air inlet pipe, the second chamber being exposed and closed by a cover which is hinged to the lower end of the dust receptaclel; and wherein

the cyclone body has a filter disposed in the second chamber.

The dust receptacle and the cover may be formed of a transparent material.

In a preferred embodiment, a latching unit is disposed at one side of each of the dust receptacle and the cover in a complementary manner to fix the cover when the cover covers the lower end of the dust receptacle.

Advantageously, the device further comprises a grip formed at a side of the dust receptacle.

A first seal may be disposed between one end of the cyclone head unit and an adjacent end of the dust receptacle to seal the cyclone chamber when the cyclone head unit and the dust receptacle are connected to each other.

In a preferred embodiment, the air inlet pipe comprises:

a first tube fixed to the cyclone head unit and having an inlet port disposed at the other end of the cyclone chamber; and

a second tube having one end connected to the first tube when the cyclone head unit and the dust receptacle are connected to each other, the other end of the

second tube being at said one end of the cyclone chamber and being in fluid communication with the second through hole.

Preferably, the air inlet pipe is provided with a back-flow prevention skirt disposed within the cyclone chamber.

The inlet port of the air inlet pipe may have a grille shape.

The invention will now be described in greater detail, by way of example, with reference to the drawings, in which:-

Figure 1 is a part-sectional side elevation illustrating the inner structure of an upright vacuum cleaner having a conventional cyclonic dust-collecting device;

Figure 2 is a part-sectional side elevation illustrating a vacuum cleaner constructed in accordance with the present invention; and

Figure 3 is an exploded perspective view illustrating the cyclonic dust-collecting device of the vacuum cleaner illustrated in Figure 2.

Referring to the drawings, Figures 2 and 3 show a vacuum cleaner 200 having a cleaner body 210, a suction port assembly 220, first and second air inlet paths 260 and 270, and a cyclonic dust-collecting device 300.

The cleaner body 210 has a vacuum generator 230, and a dust-collecting chamber 240 on which the cyclonic dust-collecting device 300 is detachably mounted. The dust-collecting chamber 240 is interposed between the first and second air inlet paths 260 and 270. The first air inlet path 260 is connected to the suction port assembly 220. The second air inlet path 270 is connected to the vacuum generator 230. The vacuum generator 230 is disposed under a lower portion of the dust-collecting chamber 240. The first air inlet path 260 interconnects an upper end portion of the dust-collecting chamber 240 with the suction port assembly 220. The second air inlet path 270 interconnects a lower end of the dust-collecting chamber 240 with the vacuum

generator 230. In this way, the second air inlet path 270 takes up less space, as compared to the corresponding second air inlet path of a conventional vacuum cleaner. The cleaner body 210 thus has a smaller size and a simpler structure.

In order to configure the second air inlet path 270 as described above, the cyclonic dust-collecting device 300 includes a cyclone body 310 and an air inlet pipe 350.

The cyclone body 310 has a cyclone head unit 320 and a dust receptacle 330, which are detachably connected to each other. A first seal 381 is disposed between the cyclone head unit 320 and the dust receptacle 330, the first seal being such as to seal the cyclone head unit with respect to the dust receptacle.

The cyclone head unit 320 is fixed at the upper end portion of the dust-collecting chamber 240, and has a first through hole 310a formed at one end for connecting to the first air inlet path 260.

The dust receptacle 330 is detachably connected to the lower end 322 of the cyclone head unit 320, and has first and second chambers 315 and 340 formed therein. A grip 333 (see Figure 3) extends from one side of the dust receptacle 330 for easy gripping thereof. The first chamber 315 forms a cyclone chamber when the dust receptacle 330 and the cyclone head unit 320 are connected to each other. Dust from drawn-in air is separated and collected in the cyclone chamber 315. The second chamber 340 is exposed and closed by a cover 360 which is rotatably hinged to the lower end 337 of the dust receptacle 330. When the second chamber 340 is closed by the cover 360, a filter chamber is formed. The cover 360 has a second through hole 310b. While the cover 360 covers an open end of the filter chamber 340 and the dust receptacle 330 is connected to the cleaner body 210, the cyclonic dust-collecting device 300 can be in fluid communication with the second air inlet path 270 through the second through hole 310b. The cover 360 is locked by a locking means constituted by a latching unit 370 disposed so as to complement latching members on the cover and the dust receptacle 330, respectively.

The air inlet pipe 350 guides the almost clean air, from which most of the dust D (see Figure 2) has been separated in the cyclone chamber 315, to the second through hole 310b. The air inlet pipe 350 has first and second tubes 350a and 350b that are connected to each other, a second seal 385 being inserted between the first and second tubes when the cyclone head unit 320 and the dust receptacle 330 are connected.

The first tube 350a is fixed to the cyclone head unit 320 so that the first tube can be located at an upper end of the cyclone chamber 315, and has an opening at the lower end of cyclone chamber. At least one slit 353 is formed at a side of the first tube 350a, the slit(s) being in fluid communication with the cyclone chamber 315. The slit(s) 353 may be formed in various shapes, but are preferably formed in a grille shape to enhance the dust-collecting efficiency of cyclonic dust-collecting device 300.

The second tube 350b has an upper end 352 which opens into the cyclone chamber 315. The upper end 352 of the second tube 350b is in fluid communication with the lower end of the first tube 350a when the dust receptacle 330 and the cyclone head unit 320 are connected to each other. The second tube 350b also has an outlet port 350c at the lower end thereof, which outlet port penetrates through the bottom side of the cyclone chamber 315, and is in fluid communication with the second through hole 310b.

The air inlet pipe 350 may be of various shapes to enhance the dust-collecting efficiency of the cyclonic dust-collecting device 300. The air inlet pipe 350 includes a back-flow prevention skirt 355 disposed at the outer circumference of the first tube 350a to prevent the dust D piled in cyclone chamber 315 from flowing into an air current ascending towards slit(s) 353 of the air inlet pipe 350.

The vacuum cleaner 200 configured in this manner further includes a filter chamber 340 for additionally separating dust contained in the air discharged from the cyclone chamber 315, thereby enhancing the cleaning efficiency of the vacuum cleaner. The filter chamber 340 is disposed at the lower end portion of the cyclone body 310, that is at the lower end of the dust receptacle 330. Hence, when the dust receptacle 330 is separated from the cyclone head unit 320, the filter chamber 340 is also separated from

the cleaner body 210, so that a user can conveniently maintain the dust receptacle and the filter chamber together, thereby facilitating the maintenance of the vacuum cleaner 200.

The filter chamber 340 is in fluid communication with the cyclone chamber 315 through the air inlet pipe 350, and has a filter 343, such as a sponge material, detachably disposed therein. By rotating the cover 360, the filter chamber 340 is exposed and closed. Accordingly, to replace or clean the filter 343, the cover 360 is manipulated to expose the filter chamber 340. The cover 360 and the dust receptacle 330 are formed of a transparent material, such as an acryl, so as to allow observation of the inside of the filter chamber 340 and the cyclone chamber 315. Hence, the user can visually check whether cleaning of the dust receptacle 330 and the filter 343 is required, thereby making the maintenance of the dust receptacle and the filter chamber 340 more convenient.

The filter chamber 340 as configured above further includes an adhesion-prevention member 365 to prevent the filter 343 from blocking the second through hole 310b due to the flow of clean air moving towards the second through hole when the vacuum generator 230 is driven. The adhesion-prevention member 365 may be formed in various shapes, such as one or more ribs that are integrally formed and extending from the cover 360 to support the filter 343 when the cover is closed.

The outlet port 350c of the air inlet pipe 350 is formed in a frustoconical shape which gradually increases in cross-section towards the lower end of cyclone body 310. The outlet port 350c divides the inside of the dust receptacle 330 into the cyclone chamber 315 and the filter chamber 340. Accordingly, the speed of clean air discharged through the outlet port 350c can be decreased to enhance the dust-separating efficiency of the filter 343.

The second air inlet path 270, which guides clean air discharged from the cyclonic dust-collecting device 300, requires less space than the conventional second air inlet path 170 of Figure 1, thereby making manufacture of the vacuum cleaner 200 easier.

Because the filter chamber 340 is integrally formed with the dust receptacle 330, and allows the user to observe the inside of not only the cyclonic dust-collecting device 300, but also the filter chamber 340, maintenance of the vacuum cleaner 200 is more convenient.

Claims

1. A cyclonic dust-collecting device for a vacuum cleaner, the device being interposed between a first air inlet path connected to a suction port assembly and a second air inlet path connected to a vacuum generator of the vacuum cleaner, the device comprising:

a cyclone body having a first through hole to be connected to the first air inlet path, a second through hole formed at one end of the cyclone body to be connected to the second air inlet path, and a cyclone chamber for centrifugally separating dust from air drawn into the chamber through the first through hole, and to collect the dust therein; and

an air inlet pipe having an inlet port disposed in the cyclone chamber and an outlet port at said one end of the cyclone body and connected to the second through hole, wherein

the outlet port of the air inlet pipe is of frustoconical shape, gradually increasing in cross-section towards said one end of the cyclone body.

2. A device as claimed in claim 1, wherein the cyclone body further comprises a filter interposed between the outlet port of the air inlet pipe and the second through hole to separate dust from the air which is discharged from the cyclone chamber and flows toward the second through hole.

3. A device as claimed in claim 2, wherein the cyclone body includes a filter chamber formed between the outlet port of the air inlet pipe and the second through hole, and the filter is detachably disposed in the filter chamber.

4. A device as claimed in claim 3, wherein the outlet port of the air inlet pipe divides the cyclone chamber from the filter chamber.

5. A device as claimed in claim 4, wherein the filter chamber is exposed and closed by a cover disposed at said one end of the cyclone body, and the second through hole penetrates through the cover.

6. A device as claimed in claim 5, wherein the filter chamber is provided with an adhesion-prevention member to prevent the filter from blocking the second through hole due to the flow of the clean air moving towards the second through hole.

7. A device as claimed in claim 6, wherein the adhesion-prevention member is integrally formed with, and protrudes from, the cover, and includes at least one adhesion-prevention rib to support the filter when the cover is closed.

8. A device as claimed in any one of claims 1 to 7, wherein the cyclone body further comprises:

a cyclone head unit provided with the first through hole; and

a dust receptacle detachably connected to the cyclone head unit and forming the cyclone chamber.

9. A cyclonic dust-collecting device for a vacuum cleaner, the device being interposed between a first air inlet path connected to a suction port assembly and a second air inlet path connected to a vacuum generator of the vacuum cleaner, the device comprising:

a cyclone body including a cyclone head unit having a first through hole to be connected to the first air inlet path and a second through hole to be connected to the second air inlet path, and a dust receptable detachably connected to the cyclone head unit and forming the cyclone chamber for centrifugally separating dust from air drawn into the chamber through the first through hole; and

an air inlet pipe having an inlet port disposed in the cyclone chamber and an outlet port at one end of the cyclone chamber and connected to the second through hole, the outlet post being of frustoconical shape, gradually increasing in cross-section towards said one end of the cyclone body, wherein the dust receptacle comprises:

a first chamber which forms the cyclone chamber when the dust receptacle and the cyclone head unit are connected to each other; and

a second chamber in fluid communication with the first chamber via the air inlet pipe, the second chamber being exposed and closed by a cover which is hinged to the lower end of the dust receptaclel; and wherein

the cyclone body has a filter disposed in the second chamber.

10. A device as claimed in claim 9, wherein the dust receptacle and the cover are formed of a transparent material.

11. A device as claimed in claim 9 or claim 10, wherein a latching unit is disposed at one side of each of the dust receptacle and the cover in a complementary manner to fix the cover when the cover covers the lower end of the dust receptacle.

12. A device as claimed in any one of claims 9 to 11, further comprising a grip formed at a side of the dust receptacle.

13. A device as claimed in any one of claims 9 to 12, wherein the air inlet pipe comprises:

a first tube fixed to the cyclone head unit and having an inlet port disposed at the other end of the cyclone chamber; and

a second tube having one end connected to the first tube when the cyclone head unit and the dust receptacle are connected to each other, the other end of the second tube being at said one end of the cyclone chamber and being in fluid communication with the second through hole.

14. A device as claimed in any one of claims 1 to 8, wherein the air inlet pipe is provided with a back-flow prevention skirt disposed within the cyclone chamber, and the inlet port of the air inlet pipe has a grille shape.

15. A device as claimed in any one of claims 9 to 13, wherein the air inlet pipe is provided with a back-flow prevention skirt disposed within the cyclone chamber, and the inlet port of the air inlet pipe has a grille shape.

16. A vacuum cleaner comprising:

a suction port assembly to draw in dust from a surface to be cleaned;

a cleaner body having a vacuum generator connected to the suction port assembly through first and second air inlet paths, with a dust-collecting chamber interposed between the first and the second air inlet paths; and

a cyclonic dust-collecting device detachably mounted in the dust-collecting chamber and connected to first and second air inlet paths;

wherein the cyclonic dust-collecting device comprises:

a cyclone body having a first through hole connected to the first air inlet path, a second through hole formed at one end of the cyclone body and connected to the second air inlet path, and a cyclone chamber for centrifugally separating dust from air drawn in through the first through hole and for collecting the dust therein; and

an air inlet pipe having an inlet port disposed in the cyclone chamber and an outlet port at said one end of the cyclone chamber and connected to the second through hole, the air inlet pipe guiding the clean air discharged from the cyclone chamber to the second through hole; and wherein

the outlet port of the air inlet pipe is of frustoconical shape, gradually increasing in cross-section towards said one end of the cyclone body.

17. A vacuum cleaner as claimed in claim 16, wherein the cyclone body further comprises a filter interposed between the outlet port of the air inlet pipe and the second through hole to separate dust from the air discharged from the cyclone chamber flowing towards the second through hole.

18. A vacuum cleaner as claimed in claim 17, wherein the cyclone body includes a filter chamber formed between the outlet port of the air inlet pipe and the second through hole, and the filter is detachably disposed in the filter chamber.

19. A vacuum cleaner as claimed in claim 18, wherein the outlet port of the air inlet pipe divides the cyclone chamber from the filter chamber.

20. A vacuum cleaner as claimed in any one of claims 16 to 19, wherein the cyclone body further comprises a cyclone head unit having the first through hole connected to

the first inlet path, and a dust receptacle detachably connected to the cyclone head unit and forming the cyclone chamber.

21. A vacuum cleaner as claimed in claim 20, wherein the dust receptacle comprises:

a first chamber defining the cyclone chamber when the dust receptacle and the cyclone head unit are connected to each other; and

a second chamber fluidly communicating with the first chamber through the air inlet pipe, and exposed and closed by a cover which is hinged to one end of the dust receptacle;

wherein the second through hole penetrates through the cover.

22. A cyclonic dust-collecting device for a vacuum cleaner, the device being substantially as hereinbefore described with reference to, and as illustrated by, Figures 2 and 3 of the drawings.

23. A vacuum cleaner substantially as hereinbefore described with reference to, and as illustrated by, Figures 2 and 3 of the drawings.